United States Environmental Protection Agency
Air and Radiation 6202J
Draft November 1998

EPA Coalbed Methane Outreach Program Technical Options Series

USING COAL MINE METHANE TO HEAT MINE VENTILATION AIR

Coal mine methane-fueled heater at one of the Jim Walter Resources mines in Alabama
(Photo courtesy of Jim Walter Resources, Inc.)

BENEFITS OF USING COAL MINE METHANE TO HEAT VENTILATION AIR

- Reduces costs by displacing other fuels that are used to heat ventilation air
- Uses a fuel that is readily available at gassy coal mines
- Reduces emissions of methane, a greenhouse gas, to the atmosphere
- Heating ventilation air in winter increases worker comfort and productivity, and reduces equipment problems

Use of coal mine methane on-site for heating ventilation air at gassy mines is potentially profitable

Why Consider Using Coal Mine Methane to Heat Ventilation Air?

Coal mines must force large quantities of air through their workings to dilute methane for safety reasons. During the winter months, this ventilation air can become very cold, causing discomfort to miners, lowering worker productivity, and resulting in mechanical problems. In cold climates, such as that of the Russia's Kuznetsk Basin, heating of ventilation air is essential. Even in mild climates, such as the southern United States, heating ventilation air during the winter months can be beneficial in terms of comfort and productivity.

The use of coal mine methane, rather than other fuels, to heat ventilation air can be an economical choice for gassy mines interested in this opportunity. Rather than purchasing natural gas, propane, fuel oil or diesel to heat mine ventilation air, it may be cheaper for the mine to use recovered methane. Some coal mines (for example, those in the Kuznetsk Basin) currently use coal-fired boilers to heat their ventilation air. Replacing some or all of this coal with coal mine methane would allow the mine to sell more coal. Use of coal mine methane is also beneficial to the environment, in that it reduces emissions of methane, a greenhouse gas, to the atmosphere.

CMOP can provide technical and financial modeling support to coal companies interested in a site-specific analysis

Gassy coal mines that currently drain methane and wish to recover it for heating mine ventilation air could accomplish this goal in several ways. The mine could use direct-fired heaters installed in the ventilation duct or mine shaft. An alternative approach would be to burn the coal mine methane in some type of combustor containing a flue for venting combustion products, and use a heat exchanger to heat the ventilation air. The financial analysis below assumes the use of a direct-fired heater.

EPA Financial Analysis

EPA's Coalbed Methane Outreach Program (CMOP) prepared an analysis to compare the cost of using recovered coal mine methane for heating ventilation air to the cost of using purchased fuel for this purpose. The analysis of any coal mine methane recovery project requires estimates of methane flow and availability at the mine. This case study builds on the following gas and financial assumption information:

Gas Availability and Use

For this illustration, the study assumes that the mine:

- produces an average of 4 million tons of coal each year;
- liberates 550 cubic feet of methane per ton of coal mined;
- uses approximately 375,000 cubic feet of ventilation air per minute;
- does not currently heat its mine ventilation air, but desires a ventilation air temperature increase of 20° for 6 months/year;
- would require 29,400 mmBtu of fuel annually to achieve this temperature; and,
- produces enough methane from existing gob wells to meet this demand (nearly 33 million cubic feet annually).

Use of coal mine methane reduces emissions of this greenhouse gas to the atmosphere

Cost[1]

The study assumes that project costs are as follows:

- *For Methane Use*: Capital costs are $94,000 (including direct-fired heater with controls, skid mounted compressor, and 1000 ft. of installed pipeline); annual operating cost is $8,000.
- *For Other Fuel Use*: Capital costs are $50,000 (for a direct-fired heater); it was conservatively assumed that there are no operating costs.

[1]These are standard cost assumptions used in most first-order CMOP financial analyses of ventilation air use.

Financial Assumptions

The analysis makes the following financial costs and assumptions:

- the project will have a 20-year life;
- annual inflation rate is 4%;
- the real discount rate is 6%;
- the tax rate is 27.5%; and
- 100% equity project financing.

Results of the Analysis

Because the mine is not currently heating its ventilation air, the analysis is a comparison of the cost of using recovered methane to heat ventilation air vs. the cost of other fuels. The following tables list the results of the analysis. Because it is strictly a cost comparison, the analysis does not include an internal rate of return or years to payback. The net present value for all fuel prices is negative, since the mine is not currently heating its ventilation air, and the model does not attempt to quantify benefits.

Use of Coal Mine Methane		
Capital Cost ('$000)	Annual Operating Cost ('$000)	**NPV ('$000)**
$94	$8	**$-150**

Use Of Alternative Fuel			
Fuel Cost [1] ($mmBtu)	Capital Cost ('$000)	Annual Fuel Cost ('$000)	**NPV ('$000)**
$3.00	$50	$92	**$ -783**
$5.00	$50	$153	**$-1,272**
$8.50	$50	$260	**$-2,128**

[1]To put these purchased fuel costs in perspective, following are typical purchase prices for various fuels, in $US per mmBtu: Natural gas - $4.75–5.75; Fuel Oil (Diesel) - $4.00-$5.00; Propane - $6.50-8.50; Electricity - $13.00-14.50.

The results of this analysis suggest recovering coal mine methane to heat mine ventilation air would be cheaper than using purchased fuels, even when the cost of purchased fuel, and equipment costs associated with using purchased fuel, are unusually low. The model does not attempt to quantify the productivity benefits that the mine could realize as a result of providing a more comfortable working environment for underground personnel. However, these productivity benefits could be significant for mines located in areas with cold winters.

To refine this analysis would require additional inputs such as actual methane emissions data, the cost of displaced fuel, and actual capital and operating costs for all alternatives. CMOP can provide the necessary technical and financial modeling support to coal companies interested in a site-specific analysis.

Contact EPA's Coalbed Methane Outreach Program for information about this and other profitable uses for coal mine methane:

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